



HSL No. 73-9

MAY 14, 1973

**THIS ISSUE CONTAINS:**

HS-012 506-HS-012 583

HS-800 147; 787; 790; 792

HS-820 210

U.S. Department of  
Transportation

National Highway  
Traffic Safety  
Administration



*Shelve in Stacks  
S.B.T.*

# Highway Safety Literature

... A SEMI-MONTHLY ABSTRACT JOURNAL

73-9

## AVAILABILITY OF DOCUMENTS

Documents listed in **Highway Safety Literature** are **not** available from the National Highway Traffic Safety Administration. They must be ordered from the sources indicated on the citations, usually at cost. Ordering information for each of the sources is listed below.

**NTIS:** National Technical Information Service, Springfield, Va. 22151. **Order by title and accession number: PB, AD, or HS.**

**GPO:** Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. **Give corporate author, title, personal author, and report number.**

**Corporate author:** Contact corporate author.

**Reference copy only:** Consult your librarian.

**See serial citation:** Obtain through normal loan or purchase.

**SAE:** Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. **Order by title and SAE report numbers.**

**HRB:** Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

Material directly related to Highway and/or Motor Vehicle Safety is solicited for inclusion in Highway Safety Literature. Topics must fall within the scope of the mission of the National Highway Traffic Safety Administration. Submit material, together with a written statement of approval for publication to:

Office of Administrative Services (N48-50)  
National Highway Traffic  
Safety Administration  
400 7th Street, S.W.  
Washington, D.C. 20590

Please indicate availability source and price for the material.

**Special notice:** Material published in HSL is intended only for information. References to brand names, equipment models or companies does not imply endorsement by the NHTSA or the U.S. Department of Transportation.

Entries in **Highway Safety Literature** are arranged in numerical order by HS accession number. Documents related directly to the National Highway Traffic Safety Administration (NHTSA) are numbered according to the following series: Accident Investigation Reports HS 600 000; Compliance Test Reports HS 610 000; Contractor's Reports HS 800 000; Staff speeches, papers, etc. HS 810 000; Imprints HS 820 000.

A document containing several articles is announced as complete volume under an HS number referring to it as a whole. Entries for individual articles are listed under their own HS numbers.

## SAMPLE ENTRIES

**JOURNAL ENTRY**

**Title of Document** { **SYNTHESIS OF CASE LAW JURISPRUDENCE RELATING TO WET-WEATHER HIGHWAY CONDITIONS**

**Journal Citation** → Highway Research Record n 376 p29-36 (1971)

**Author(s)** → D. C. Oliver 1971

Sponsored by Highway Res. Board Steering Com. for Workshop on Anti-Skid Program Management and presented at the workshop.

**Search Terms** { Descriptors: \*Liability, \*Negligence, \*Accident responsibility, \*Legal responsibility, \*Wet road conditions, \*Court decisions, \*State government, \*Skidding accidents, \*Warning signs, \*Highway maintenance, \*Litigation, \*Icy road conditions,

**Abstract** { The extant case law on legal liability for accidents occurring on icy and wet highways has established three central areas and one subarea in the jurisprudence of maintenance liability. These areas are compliance with general duties in order to escape liability; damages resulting from noncompliance (negligence); contributory negligence as a bar to recovery; and advisory signing as a technique in meeting general duties. Court decisions covering these four areas are presented.

**NHTSA Accession Number** → HS-012 289

\*Subject heading in Subject Index

**CONTRACT REPORT**

**EQUIPMENT AND PROCEDURES FOR MEASURING GLARE FOR MOTOR VEHICLES. FINAL REPORT**

**Corporate author** → Teledyne Brown Engineering

**Availability** → N. E. Chatterton J. D. Hayes E. W. George 1972 102p

Contract DOT-HS-089-1-139

NTIS

Descriptors: \*Glare, \*Glare reduction, \*Visual perception, \*Photometers, \*Luminance, \*Hydraulic equipment, \*Central vision, \*Field of view, \*Backgrounds, \*Contrast, \*Light conditions, \*Brightness, \*Test facilities, \*Test equipment, \*Vehicle safety standards, \*Simulators, \*Light, \*Reflectance, \*Measuring instruments,

A procedure and description of equipment for measuring glare from a driver's own vehicle are presented. The procedures are based on a disability glare theory as applied to foveal vision. Two pieces of apparatus were constructed to provide the measurement capability. One of them simulates diffuse sky glare and the other simulates direct solar glare. Methods of combining data from these measurements are presented along with scaling laws selected to provide a value for glare as it would be under natural daylight conditions. A standard for allowable glare levels from the vehicle is developed which is independent of the measurement procedure. Test results from a passenger car are presented and compared with this standard. Recommendations for improvements to the apparatus and additional research requirements for improvement to the theory are made.

HS-800 731

\*Subject heading in Subject Index

## 1. ACCIDENTS

### 1A. Emergency Services

#### EMERGENCY MEDICAL CARE

Italy Ministry of Health, I53130  
G. Spalatin  
In HS-012 507

\*Emergency medical services, \*Emergency training, \*Emergency reporting systems, \*Emergency equipment, \*Transportation of injured, \*Questionnaires, \*International factors.,

An analysis of the various stages of emergency medical care operations is made, with reference to the role played by the different components of the system. Suggestions are made for improving emergency medical services (EMS). Benefit cost analysis and systems analysis are stressed as important tools in planning and evaluating EMS programs. The work completed in the EMS pilot study of the Committee of the Challenges of Modern Society's road safety project is also described. A questionnaire aimed at assessing the present situation of emergency medical services in the participating countries; exploring future organizational and operative developments of the services; and detecting relevant EMS problems already subject to research in the respective countries, was developed. The general pattern of the organization of emergency medical services employed by the participating countries, as revealed by replies to the questionnaires, is summarized.  
HS-012 531

#### DOA OR ... THE EMERGENCY PROBLEM

V36 N1  
W. L. Roper  
See serial citation

\*Ambulance personnel training, \*Ambulance design, \*Emergency medical services, \*First aid equipment, \*Emergency reporting systems, \*Fatality prevention, \*Roadside telephones, \*Transportation of injured, \*California, \*Chicago, \*Iowa,

It is estimated that trained ambulance crews and properly equipped ambulances could reduce accident fatalities by 10 to 20% annually. Emergency services are inadequate in rural areas, but California has begun using helicopter ambulances in remote locations. A study conducted by the Claremont Colleges concluded that separate, poorly coordinated communication systems between sheriff, police, fire department, highway patrol, and ambulance services seriously impede the efficient provision of emergency care. The importance of having a single emergency phone number to avoid confusion is emphasized. Ambulance service is inadequate because it has been unable to pay its own way, and patients are sometimes subjected to high-pressure tactics used by ambulance operators attempting to collect fees.  
HS-012 545

### 1B. Injuries

#### SOME EPIDEMIOLOGIC FEATURES OF MOTORCYCLE INJURY IN A CALIFORNIA COMMUNITY. PRELIMINARY REPORT

California Univ., Davis, C14800  
J. F. Kraus R. S. Riggins W. Drysdale C. E. Franti

Sponsored by Insurance Inst. for Hwy. Safety. Presented at 100th annual meeting of the American Public Health Assoc., Atlantic City, 14 Nov 1972.  
Corporate author

\*Motorcycle accidents, \*Injury statistics, \*Motorcycle operator fatalities, \*Motorcycle passenger injuries, \*Motorcycle passenger fatalities, \*Injuries by age, \*Injuries by sex, \*Injury rates, \*Injuries by vehicle make, \*Injury severity, \*Motorcycle operator education, \*Accident factors, \*Time of accidents, \*Injuries by accident type, \*California, \*Fractures, \*Epidemiology, \*Fatality rates, \*Fatalities by age, \*Engine size, \*Fatalities by sex, \*Motorcycle operator injuries,

This investigation was basically a retrospective study of persons killed or injured as a result of a motorcycle collision in Sacramento County, California during 1970. The differences between injury involved drivers and vehicles, and a randomly selected comparison group of vehicles and their usual drivers were investigated. In addition, death rates were derived for certain population groups defined by age and sex. Motorcycle operator, environmental, and vehicle factors associated with motorcycle fatalities and injuries are presented.  
HS-012 556

#### HUMAN BODY INJURY AND VEHICLE CRASH DAMAGE

Traffic Injury Res. Foundation of Canada, T30600  
E. O'F. Campbell  
Corporate author

\*Injury severity, \*Damage severity, \*Injury severity index, \*Damage severity index, \*Injury prediction from vehicle damage, \*Fatalities, \*Head injuries, \*Rollover accidents, \*Injury research, \*Accident investigation, \*Accident report forms, \*British Columbia,

During the period 1 June 1970 to 31 May 1971, accidents involving injuries were investigated by Royal Canadian Mounted Police in British Columbia to determine the relationship between vehicle damage and injury severity. Injury severity and damage severity scales were developed. Results are tabulated and show that the number and severity of injuries tend to increase as vehicle damage increases and that 75% of fatal injuries occurred in most severely damaged vehicles. Data on cranial injuries indicate that almost 80% of cranial injuries were relatively minor and almost 75% of fatal cranial injuries occurred in association with severe vehicle damage. Data on injuries, fatalities, and vehicle damage in rollover accidents show similar pattern.  
HS-012 564

### 1C. Investigation And Records

#### THE WORLDWIDE NEED FOR VEHICLE AND HIGHWAY SAFETY: VIEWPOINT OF THE CONCERNED CITIZEN

National Safety Council, N25800  
For primary bibliographic entry see Fld. 2.  
HS-012 510

#### IMPROVING FREEWAY SAFETY THROUGH DESIGN AND OPERATIONS

Calif. Univ. Inst. of Transp. and Traf. Engineering, C17000  
For primary bibliographic entry see Fld. 2I.

## Group 1C—Investigation And Records

HS-012 522

**ACCIDENT AND TRAFFIC CONFLICTS AT JUNCTIONS**

Transport and Road Res. Lab. (England), T33900  
K. Russam B. E. Sabey  
In HS-012 507

\*Intersection collisions, \*Accident risk forecasting, \*Accident statistics, \*Rural intersections, \*Urban intersections, \*Rural accidents, \*Urban accidents, \*Traffic surveillance, \*Highway accident potential, \*Accident studies, \*Great Britain, \*Accident location, \*Injury severity, \*Traffic conflicts, \*Driver age, \*Driver error caused accidents, \*Accident causes,

An analysis of accident data from the 1970 National Accident Statistics indicates the seriousness of the intersection accident problem in Great Britain. Two techniques for evaluating the accident risk potential of intersections are described. One method assesses the safety of an individual intersection by studying the vehicle movements which result in near accident or conflict situations. The other method combines accident data for intersections of similar layout by location sampling. Examples of the application of these techniques to rural junctions are given and possible remedial measures are considered. The need to extend this work to urban junctions is stressed.

HS-012 524

**ACCIDENT INVESTIGATION AS A PART OF THE ROAD SAFETY PROJECT UNDER NATO-CCMS**

Netherlands Ministry of Transport, N3650006HS-012 507, International Vehicle and Highway Safety Conference Proceedings, New York, 1973 p170-2

In HS-012 507

\*Accident investigation, \*Multidisciplinary teams, \*Research methods, \*International factors,

The progress of the Committee on Challenges of Modern Society's pilot accident investigation project is reported. An accident investigation process for collecting vehicle damage and correlative injury information that will aid automobile designers in producing safer vehicles, and governments in evaluating the performance of existing safety standards, has been developed. The feasibility and practicality of this process is being tested in member countries. The process includes the vehicle damage index as a system for quantitatively and qualitatively describing the vehicle condition following a crash; the injury severity index as a system for standardizing medical descriptions of the injured after a crash; and field procedures whereby engineers and physicians are dispatched to the scene to record necessary information regarding the accident.

HS-012 530

**TRANSPORTATION SAFETY PRIORITIES OF THE FUTURE: FIRST TIME SAFE**

National Transp. Safety Board, N30000  
J. H. Reed  
In HS-012 507

\*Accident prevention, \*Accident risk forecasting, \*Systems analysis, \*Accident risks, \*Highway safety programs,

The traditional approach implemented to reduce traffic accidents has depended to a large extent on focusing effort on those areas where accidents have occurred. The process is to analyze the accidents, find their causes, and then implement corrective action that will prevent their reoccurrence. The problem with this approach is that a certain accident frequency must be sustained before a problem is identified as existing. The first time safe concept, a new approach to accident prevention is discussed. This approach is based on discovering the hazards in a system before accidents occur and then managing the risks associated with each hazard. Results achieved using the techniques of risk management and system safety for purposes of hazard identification, have demonstrated the merits of this approach.

HS-012 537

**ACCIDENT EXPERIENCE ON SPEED-CHANGE LANES OF THE INTERSTATE HIGHWAY SYSTEM**  
V37 N2

J. C. Fee

See serial citation

\*Interstate highway system, \*Acceleration lanes, \*Deceleration lanes, \*Speed changes, \*Urban accidents, \*Rural accidents, \*Mathematica,

Of all accidents on the Interstate System, 15.7% occur on urban speed-change lanes and 9.6% on rural speed-change lanes due to

HS-012 541

**SCHOOL BUS SAFETY: A LESS THAN PASSING GRADE?**

For primary bibliographic entry see Fld. 5B.

HS-012 554

**SAFETY AND THE YELLOW BUS**

For primary bibliographic entry see Fld. 5B.

HS-012 555

**THE ESTIMATION OF ACCIDENT IMPACT SPEED**

Cornell Aeronautical Lab., Inc., C67200  
R. P. Mason D. W. Whitcomb CAL-YB-3109-V-1  
Corporate author

\*Impact velocity, \*Mathematical analysis, \*Vehicle vehicle impact tests, \*Crush tests, \*Head on impact tests, \*Side impact tests, \*Pole impact tests, \*Guardrail impact tests, \*Impact angle, \*Rear end impact tests, \*Automobile models, \*Deformation analysis, \*Crush distance, \*Vehicle size, \*Vehicle age, \*Front engine automobiles, \*Front wheel drive automobiles, \*Rear engine automobiles, \*Energy absorption, \*Foreign automobiles, \*Least squares method, \*Unitized body construction, \*Frame tests, \*Equations,

Data available in the literature and from some unreported results of vehicle vehicle frontal, side, and rear impact tests, and single vehicle pole and guardrail impact tests are examined in terms of vehicle crush properties, type of impact, type of vehicle, speed of impact, and object struck. Approximate formulae are given for estimating impact speeds for various accident vehicles and conditions.

HS-012 558

**PILOT STUDY OF HOUSETRAILER AND TRUCK CAMPER SAFETY, PHASE 2. FINAL REPORT**  
California Univ., Inst. of Transp. and Traf. Engineering, C17000  
For primary bibliographic entry see Fld. 5T.  
HS-012 560

**A STUDY OF ACCIDENT RATES AMONGST MOTORISTS WHO PASSED OR FAILED AN ADVANCED DRIVING TEST**  
Transport and Road Res. Lab. (England), T33900  
For primary bibliographic entry see Fld. 3F.  
HS-012 563

**HUMAN BODY INJURY AND VEHICLE CRASH DAMAGE**  
Traffic Injury Res. Foundation of Canada, T30600  
For primary bibliographic entry see Fld. 1B.  
HS-012 564

**ROADWAY DELINEATION SYSTEMS**  
Pennsylvania State Univ., P07800 Institute for Res., I29400  
For primary bibliographic entry see Fld. 2L.  
HS-012 572

**MULTIDISCIPLINARY ACCIDENT INVESTIGATIONS, PHASE 6. FINAL REPORT**  
Georgia Inst. of Tech., G16200  
For primary bibliographic entry see Fld. 1E.  
HS-800 792

## 1D. Locations

### IDENTIFICATION AND TREATMENT OF ROAD HAZARDS04M. Frybourg

Institute for Traf. Transp. Res. (France), I30400  
In HS-012 507

\*Accident location, \*Highway accident potential, \*Accident records, \*Traffic records, \*Hazards, \*Highway improvements, \*Surveys, \*International factors, \*Program evaluation,

France, as pilot country for the Committee on the Challenges of Modern Society's identification and treatment of road hazards project, developed and distributed a questionnaire to determine the methods each country uses for identifying hazardous locations and correcting them. A follow-up seminar was conducted in Paris. Main results of the survey and conclusions of the seminar are presented. Respondents to the questionnaire included Canada, Colorado, Denmark, Ireland, Italy, Maryland, Michigan, Netherlands, Pennsylvania, United Kingdom, and West Germany. The use or nonuse of accident records, traffic records, and statistical and analytical methods in identifying accident locations is indicated for each participating country.  
HS-012 528

## 2. HIGHWAY SAFETY

### INTERNATIONAL VEHICLE AND HIGHWAY SAFETY CONFERENCE, MAY 30--JUNE 2, 1972, WASHINGTON, D.C. PROCEEDINGS

Society of Automotive Engineers, Inc., S21600

SAE-P-43  
Sponsored by National Hwy. Traf. Safety Administration, Federal Hwy. Administration, and National Transp. Safety Board. Includes HS-012 508 through HS-012 540.  
SAE

\*Highway safety programs, \*Accident prevention, \*Highway safety, \*Vehicle safety, \*Intergovernmental relations, \*Safety research, \*Driver vehicle road interfaces, \*Safety program effectiveness, \*Driver behavior, \*Safety design, \*Program evaluation, \*Priorities, \*Benefit cost analysis, \*International factors, \*Highway accident potential, \*Driver performance, \*Hazards, \*Pedestrian safety, \*Accident investigation, \*Emergency medical services, \*Alcohol usage, \*Vehicle inspection, \*Safety cars,

The purpose of this conference was to foster international cooperation in the field of highway and vehicle safety. Topics covered at the conference included U. S., European, and international organizations' approaches to road safety and progress in creating an international approach; methods of planning, managing, implementing, and evaluating highway safety programs; current safety research efforts; and identification of future priorities in highway safety. The activities of the Committee on the Challenges of Modern Society's safety pilot studies on identification and treatment of road hazards, pedestrian safety, accident investigation, emergency medical care, alcohol and highway safety, vehicle inspection, and experimental safety vehicles are also reported.  
HS-012 507

### THE WORLDWIDE NEED FOR VEHICLE AND HIGHWAY SAFETY: EUROPEAN VIEWPOINT

Belgium Ministry of Transport and Communications, B06700  
J. Vrebos  
In HS-012 507

\*Safety research, \*Intergovernmental relations, \*Highway safety, \*Vehicle safety, \*Standardization, \*Safety standards, \*International factors,

Official international organizations as well as some private organizations involved in road safety research, standardization, and legislation are listed. Brief descriptions of the organizations, including the specific areas of highway safety each organization is working on, are presented.  
HS-012 508

### THE WORLDWIDE NEED FOR VEHICLE AND HIGHWAY SAFETY: UNITED STATES VIEWPOINT

Department of Transp., D17400  
J. M. Beggs  
In HS-012 507

\*Accident prevention, \*Safety programs, \*Crashworthiness, \*Federal role, \*Driver vehicle road interfaces, \*International factors, \*Priorities,

The approach taken by the U. S. Government in dealing with highway and vehicle safety is briefly described. It is concluded that for any government to deal effectively with the traffic death problem it should adopt a systems approach which deals with each problem element--the driver, the vehicle, and the highway. With each element attention must go both to preventing crashes and to reducing casualties for crashes which can't

## Field 2—HIGHWAY SAFETY

HSL 73, No. 09

### Group 1D—Locations

be avoided. Priorities should be selected so that limited resources attack areas where the greatest number of lives can be saved in the shortest time period. The choice of specific countermeasures will depend on each country's unique situation. International commonality will come more easily in methodology and data than in programs.  
HS-012 509

### THE WORLDWIDE NEED FOR VEHICLE AND HIGHWAY SAFETY: VIEWPOINT OF THE CONCERNED CITIZEN

National Safety Council, N25800  
H. Pyle  
In HS-012 507

\*Safety program effectiveness, \*Accident prevention, \*Accident rates, \*Driver education, \*Defensive driving, \*Highway safety programs,

The present traffic accident situation in the U. S. is discussed. It is contended that the main thrust of accident prevention efforts should be focused on the driver, rather than on the highway or vehicle. Accident rates are discussed and the reductions achieved by defensive driving course graduates are given.  
HS-012 510

### THE WORLDWIDE NEED FOR VEHICLE AND HIGHWAY SAFETY: INTERNATIONAL STANDARDS

INTERNATIONAL ROAD FEDERATION, I44400  
R. O. Swain  
In HS-012 507

\*Standardization, \*Highway safety standards, \*Vehicle safety standards, \*Intergovernmental relations, \*International factors, \*Highway design, \*Sign uniformity, \*Traffic law uniformity, \*Driver education,

The need for a worldwide coordination of efforts to improve vehicle and highway safety is discussed. The development and adoption of international standards for vehicle components, highway design, signs, signals, and markings, road traffic codes, driver education, and licensing requirements are considered to be most effective means of achieving this goal. The adoption of standard vehicle safety features are on the way to becoming worldwide standards. With respect to the highway and driver, many countries have national standards which through international collaboration could be further developed into worldwide standards.  
HS-012 511

### 2D. Design And Construction

#### UK VIEW OF THE RELATIVE IMPORTANCE OF ROAD SAFETY FEATURES

England Dept. of the Environment, E08100  
D. J. Lyons  
In HS-012 507

\*Accident prevention, \*Safety program effectiveness, \*Driver behavior, \*Vehicle design, \*Safety design, \*Display systems, \*Occupant protection, \*Injury prevention, \*Driver education, \*Accident risk forecasting, \*Law enforcement effect on ac-

cident rates, \*Fatality rates, \*Pedestrian safety, \*Accident rates, \*United Kingdom, \*Skidding accidents, \*Alcohol laws, \*Highway design,

Present and projections of future highway accident trends in the United Kingdom are presented. Driver, vehicle, and road related accident countermeasures and their effectiveness in reducing accident rates are discussed. Road safety program priority areas are identified: improvement of urban pedestrian safety; development of occupant protection systems and adoption of automobile safety devices; improvement of commercial vehicle's braking and stability, and improvement of driver education and driver control programs.  
HS-012 512

### IMPROVING FREEWAY SAFETY THROUGH DESIGN AND OPERATIONS

Calif. Univ. Inst. of Transp. and Traf. Engineering, C17000  
For primary bibliographic entry see Fld. 2I.  
HS-012 522

### HIGHWAY DESIGN TO MINIMIZE THE FREQUENCY AND CONSEQUENCES OF ACCIDENTS

New York State Dept. of Transp., N52200  
G. W. McAlpin  
In HS-012 507

\*Highway design, \*Highway characteristics, \*Pavement skid resistance, \*Barrier design, \*Impact attenuators, \*Breakaway structures, \*Highway improvements, \*Roadside hazards, \*Guardrail design,

In the design, construction, and maintenance of highways, three areas show considerable promise for reducing accidental death and injury. These areas are geometric design, pavement skid resistance, and roadside furniture (barriers, crash cushions, and breakaway structures). A general discussion of each area is presented and recent advancements in these fields, and areas needing further research are mentioned.  
HS-012 525

### IDENTIFICATION AND TREATMENT OF ROAD HAZARDS04M. Frybourg

Institute for Traf. Transp. Res. (France), I30400  
For primary bibliographic entry see Fld. 1D.  
HS-012 528

### MOBILITY WITH SAFETY

International Road Federation, I44400 Minnesota Mining and Mfg. Co., M48000  
H. Heltzer  
In HS-012 507

\*Driver vehicle road interfaces, \*Highway safety programs, \*Priorities, \*Driver attitudes, \*Vehicle design, \*Highway design, \*Human factors,

Relative priorities assigned to safety measures are based on a system of trade-offs with mobility, within the framework of the available resources. These resources are limited by the need to solve other broad social problems. Three factors in highway safety—driver, vehicle, and road—are examined in the light of future possibilities, with suggestions for more effective worldwide application of successful innovations in traffic safety.

May 14, 1973

## HIGHWAY SAFETY—Field 2

### Traffic Control—Group 21

HS-012 538

## 2G. Meteorological Conditions

### DOT'S FOUR-POINT PROGRAM TO REDUCE TRUCK NOISE

V81 N2  
Department of Transp., D17400  
W. H. Close  
See serial citation

\*Trucks, \*Noise control, \*Noise standards, \*Acoustic measurement, \*Diesel engines, \*Truck tires, \*Tire noise, \*Fan noise, \*Engine noise, \*Exhaust noise, \*Mufflers, \*Inspection equipment, \*Measuring instruments, \*Vehicle inspection, \*Police training, \*Test equipment, \*Road tests, \*Government industry cooperation,

DOT's program is divided into the following activities: truck tire noise research, diesel truck noise reduction demonstration project, diesel truck muffler/fan optimization, and highway patrol training/equipment provisioning. Government and industry are cooperating to meet the diesel engine noise level goal of 75-78 dB (A) maximum at 50 feet. Training courses for highway patrolmen and state officials and provision of inspection equipment will enable effective enforcement of roadside and vehicle noise limits. Tests have been developed to relate roadside checks to over-the-road noise exposure by measuring in-cab sound levels for up to 10 hours of continuous vehicle operation.  
HS-012 549

### SAFETY, NOISE, AND EMISSIONS STRESSED IN NEW BRITISH VEHICLES

V81 N2  
M. Platt  
See serial citation

\*British vehicles, \*Exhaust emission control, \*Noise control, \*Engine design, \*Engine noise, \*Trucks, \*Diesel engines, \*Automobile models, \*Automobile engines, \*Safety devices, \*Automatic transmissions, \*Vehicle design, \*Safety design, \*Production statistics, \*Weight to power ratio, \*Turbocharging, \*Aftercoolers, \*Vehicle noise,

British automotive engineers are attempting to meet environmental and legislative restrictions, but do not consider it practical or desirable to keep up with U. S. federal standards. Diesel engine power output has had to be reduced to meet smoke limits. Vehicles manufactured since October 1972 must have sufficient installed power to provide 6bhp per long ton gross weight. In an attempt to meet proposed future uniform European noise standards, vehicle manufacturers are redesigning engine structures, and new engine types are described. Turbocharging, with intercooling, is one of the techniques being used to help reduce noise and emissions, as well as to improve power/weight ratios. Development of new automatic transmission systems is outlined. Safety features of the Vauxhall Victor 2300 and British vehicle production statistics are presented.  
HS-012 550

### SKID RESISTANCE AND DIRECTIONAL CONTROL

Natural Rubber Producers' Res. Assoc., Inc. (England), N30800  
For primary bibliographic entry see Fld. 5V.  
HS-012 582

## 2H. Police Traffic Services

### SELECTIVE TRAFFIC ENFORCEMENT PROGRAM PLANNING GUIDE. REV. ED.

National Hwy. Traf. Safety Administration, N19900

Revision of Oct 1971 ed. enforcement against related accident-causative violations. An outline of the STEP plan and guidelines for preparing the plan, with information on administration, operations, community profile, and program management, are included. Examples of public information, police, judicial, and traffic engineering countermeasures are presented, and a classification list of hazardous traffic law violations is included.  
NTIS

\*Traffic law enforcement, \*Accident prevention, \*Highway safety programs, \*Systems analysis, \*Planning, \*Accident location, \*Traffic law violations, \*Data acquisition, \*Accident report forms, \*Accident factors, \*Accident causes, \*Accident diagrams, \*Police law enforcement responsibilities, \*Budgets, \*Traffic engineering, \*Courts, \*Traffic surveillance, \*Public information programs, \*Selective Traffic Enforcement Program, \*Management, \*Driver error caused accidents,

A systems approach to a program plan is presented. The objective of the Selective Traffic Enforcement Program (STEP) is to reduce the number and frequency of motor vehicle traffic accidents in which traffic violations are a causal factor. Selective enforcement defines the traffic accident problem in terms of high frequency accident locations during selected time periods and applies enforcement against related accident-causative violations. An outline of the STEP plan and guidelines for preparing the plan, with information on administration, operations, community profile, and program management, are included. Examples of public information, police, judicial, and traffic engineering countermeasures are presented, and a classification list of hazardous traffic law violations is included.  
HS-820 210

## 2I. Traffic Control

### HIGHWAY SAFETY: TRAFFIC MANAGEMENT BY TRAFFIC SIGNAL SYSTEMS

Australia Dept. of Motor Transport, A76000  
R. A. French  
In HS-012 507

\*Traffic management, \*Traffic control, \*Traffic signal effectiveness, \*Traffic signal networks, \*Traffic signal visibility, \*Driver reaction distance, \*Traffic signal coordination, \*Traffic flow, \*Driver vehicle road interfaces, \*Accident rates, \*New South Wales, \*Benefit cost analysis, \*Precrash phase, \*Crash phase, \*Postcrash phase, \*Fatality rates, \*Central business districts,

A traffic accident is defined as the result of a breakdown in the overall traffic system which involves the complex interaction between the driver, vehicle, highway, and environment. Traffic signal systems when properly engineered can effectively reduce traffic accidents at such a rate that the indicated cost benefits more than justify the substantial expenditure for their installation and maintenance. Specific types of traffic signal systems used in New South Wales and their effectiveness are discussed.



## Field 2—HIGHWAY SAFETY

### Group 21—Traffic Control

HS-012 518

#### IMPROVING FREEWAY SAFETY THROUGH DESIGN AND OPERATIONS

Calif. Univ. Inst. of Transp. and Traf. Engineering, C17000  
A. D. May  
In HS-012 507

\*Accident risk forecasting, \*Highway design, \*Freeway planning, \*Freeways, \*Traffic capacity, \*Traffic volume, \*Traffic density, \*Traffic models, \*Highway accident potential, \*Highway characteristics, \*Accident rates, \*Traffic flow, \*Traffic disturbances,

The need for a systematic approach to the design-operations safety evaluation process is emphasized, and a current research project which is attempting to develop and test a systematic approach for evaluating existing and planned freeways in terms of safety, efficiency, and convenience is described. The research project is based on the hypothesis that accident experience is related to internal friction (freeway volume-capacity ratio). Thus if volume-capacity ratios can be determined, accident experience can be predicted, and highway safety standards established. An existing freeway model which will be extended to include this safety evaluation process is briefly described. Highlights of completed research which related specific design elements and traffic intensity levels to accident experience on a quantitative basis are also presented.

HS-012 522

#### ACCIDENT EXPERIENCE ON SPEED-CHANGE LANES OF THE INTERSTATE HIGHWAY SYSTEM

For primary bibliographic entry see Fld. 1C.  
HS-012 541

#### NATIONAL CONFERENCE ON RAILROAD-HIGHWAY GRADE CROSSING SAFETY, PROCEEDINGS, AUGUST 29-31, 1972

Department of Transp., D17400 Highway Res. Board, H09600  
National Safety Council, N25800

Held at Ohio State Univ., Columbus.

\*Railroad grade crossings, \*Vehicle train collisions, \*Federal role, \*Railroad grade crossing signals, \*Railroad grade crossing signs, \*Benefit cost analysis, \*Urban planning, \*Railroad location, \*Railroad grade crossing accidents, \*Automatic railroad grade crossing gates, \*Highway safety programs, \*Warrants, \*Regression analysis, \*Federal aid, \*Accident prevention, \*Accident risk forecasting, \*Highway improvements14Ohio State Univ.,

There are over 220,000 public grade crossings in the U. S. where 12,000 vehicle train collisions occur annually, resulting in 15,000 deaths and 7,000 injuries. Urban railroad problems are discussed, and railroad-highway grade crossing relocation away from congested areas is suggested. Benefit cost analysis of safety features is included. Operation, maintenance, and improvement of railroad grade crossing signals, signs, and gates; problems related to implementation of a railroad-highway grade crossing safety program; and warrants for safety improvements at rail-highway grade crossings are discussed. Regression analysis is used to estimate railroad grade crossing accidents. A Department of Transportation report to Congress on railroad-highway crossing safety is presented and evaluated.

HSL 73, No. 09

HS-012 557

#### IMPROVED CRITERIA FOR TRAFFIC SIGNAL SYSTEMS IN URBAN NETWORKS

Planning Res. Corp., P24600 Voorhees (Alan M.) and Associates, Inc., V18600  
F. A. WagnerF. C. BarnesD. L. GerloughNCHRP-124  
Sponsored by the American Assoc. of State Hwy. Officials in cooperation with the Federal Hwy. Administration  
HRB \$4.80

\*Traffic signal networks, \*Traffic control optimization, \*Urban traffic flow, \*Traffic signal effectiveness, \*Traffic signal timing, \*Computerized simulation, \*Simulation models, \*Area traffic control, \*Field tests, \*Electronic traffic control, \*Traffic signal coordination, \*Los Angeles, \*San Jose, \*Peak hour traffic, \*Signalized intersections, \*Central business districts, \*Traffic signal cycle length, \*Traffic volume, \*Variance analysis, \*Speed and delay data,

By use of computer simulation techniques and field testing, several methods of operating a network of urban traffic signals were scientifically tested to determine the comparative effectiveness of alternate timing methods. Two California grid networks were used as test sites—a 26-intersection network in Los Angeles, and a 22-intersection network in San Jose. Comprehensive field studies conducted in Los Angeles served to test three different signal system timing alternatives under actual operating conditions and the validity of the simulation predictions.

HS-012 571

#### ROADWAY DELINEATION SYSTEMS

Pennsylvania State Univ., P07800 Institute for Res., I29400  
J. I. TaylorH. W. McGeeE. L. SeguinR. S. HostetterNCHRP-130  
Sponsored by the American Assoc. of State Hwy. Officials in cooperation with the Federal Hwy. Administration  
HRB \$14.00

\*Delineators (traffic), \*Driving task analysis, \*Benefit cost analysis, \*Rural highways, \*Two lane roads, \*Colored pavements, \*Raised pavement markings, \*Centerline markings, \*Pavement edge markings, \*Reflectorized road shoulder markings, \*Reflectorized pavement markings, \*Field tests, \*Driver performance, \*Color coding, \*Accident prevention, \*Highway characteristics, \*Pavement marking uniformity, \*International factors, \*Reflectance, \*Reflective materials, \*Color, \*Visibility,

Laboratory studies were conducted by experimental psychologists to develop and evaluate concepts basic to delineation requirements, such as positive vs negative delineation, clutter of the visual environment, overdelineation, target value, and aspects of color and shape coding. Field experiments were conducted to evaluate the effectiveness of use of post delineation and/or raised pavement markers at horizontal curves, use of colored pavements, variations in centerline markings, and variations in color and spacing of post delineators at stop approaches. Driving task analysis was performed at tangent sections, horizontal curves, no-passing zones, pavement width transitions, merging-diverging areas, turns, turns with deceleration and/or storage lanes, stop approaches, and railroad crossing, and crosswalks on rural two lane roads to determine driver delineation information needs. Benefit cost analysis of delineation systems is presented. Analyses of accident records verify that major safety benefits come from the presence of standards delineation treatments.

HS-012 572

**3. HUMAN FACTORS****INTERNATIONAL VEHICLE AND HIGHWAY SAFETY CONFERENCE, MAY 30–JUNE 2, 1972, WASHINGTON, D.C. PROCEEDINGS**

Society of Automotive Engineers, Inc., S21600  
For primary bibliographic entry see Fld. 2.  
HS-012 507

**3A. Alcohol****PLANNING OF SAFETY PROGRAMS--DRIVER/VEHICLE**

Canada Ministry of Transport, C26000  
For primary bibliographic entry see Fld. 4D.  
HS-012 517

**AN INTERNATIONAL STUDY OF ALCOHOL AND HIGHWAY SAFETY--INTERIM REPORT**

Canada Ministry of Transport, C26000  
G. D. Campbell  
In HS-012 507

\*Alcohol usage deterrents, \*Drinking drivers, \*Alcohol laws,  
\*Blood alcohol levels, \*Safety program effectiveness, \*Canada,  
\*Alcohol breath tests, \*Surveys, \*International factors,

Activities of the Committee on the Challenges of Modern Society's alcohol and highway safety project are reported. Twenty-seven countries participated in a world survey, conducted by Canada, on alcohol countermeasures. Initial findings of the survey have verified that many countries consider alcohol and driving to be a problem of major concern. Fourteen of the respondents employ public education techniques directed at drinking and driving. Legislation dealing with drinking and driving has been introduced by 16 of the respondents, and 10 countries now employ alcohol breath testing devices. Working through both N.A.T.O. and the Organization for Economic Cooperation and Development, the Canadian Government has been successful in obtaining the participation of 16 countries in a proposed international program of roadside surveys of drinking driver behavior. The need for these surveys is discussed. Recent countermeasures employed in Canada are also briefly reviewed.

HS-012 533

**SAFETY PRIORITIES OF THE FUTURE--DRIVER CONTROL PROGRAM**

Department of Transp., D17400  
For primary bibliographic entry see Fld. 3D.  
HS-012 536

**BEHAVIOR MODIFICATION AS A COUNTERMEASURE FOR THE DRINKING DRIVER**

V2N1  
T. KoleF. Watman  
See serial citation

\*Alcohol usage deterrents, \*Drinking drivers, \*Driver rehabilitation, \*Reinforcement (psychology), \*Driver behavior research, \*Problem drivers, \*Driver motivation, \*Attitude changes, \*Hypnosis, \*Behavior modification,

A countermeasure program to rehabilitate drinkers who drive is proposed in accordance with a behavior modification paradigm. In the proposed treatment program, an attempt is made to alter the maladaptive behavior, driving after drinking, by manipulating environmental stimuli through the following techniques: selective positive reinforcement; aversive conditioning; modeling; and suggestion-relaxation. The proposed program can vary from a minimum of 10 hours to a maximum of 30 hours depending upon the progress of each individual driver. The program includes the presentation of appropriate didactic materials, the discussion of and encouragement to use alternatives to driving after drinking, and three brief follow-up reinforcement sessions.

HS-012 565

**3C. Cyclists****SOME EPIDEMIOLOGIC FEATURES OF MOTORCYCLE INJURY IN A CALIFORNIA COMMUNITY. PRELIMINARY REPORT**

California Univ., Davis, C14800  
For primary bibliographic entry see Fld. 1B.  
HS-012 556

**3D. Driver Behavior****THE WORLDWIDE NEED FOR VEHICLE AND HIGHWAY SAFETY: VIEWPOINT OF THE CONCERNED CITIZEN**

National Safety Council, N25800  
For primary bibliographic entry see Fld. 2.  
HS-012 510

**UK VIEW OF THE RELATIVE IMPORTANCE OF ROAD SAFETY FEATURES**

England Dept. of the Environment, E08100  
For primary bibliographic entry see Fld. 2D.  
HS-012 512

**MANAGEMENT OF HIGHWAY SAFETY PROGRAMS--THE DRIVER HAS THE KEY**

Texas Hwy. Dept, T15600  
J. C. Dingwall  
In HS-012 507

\*Driver improvement, \*Driver attitudes, \*Driver behavior,  
\*Accident rates, \*Texas,

The driver's role in accident prevention is discussed. Driver attitudes are viewed as playing a primary role in both causing and preventing accidents. It is concluded that only when each driver adopts the attitude that every other driver has as much right to the road as he has and that he must look out for every other driver, can a reduction in traffic accidents be expected; and the ways to instill this attitude are by driver training and stricter laws and enforcement.

HS-012 515

**IMPROVED DRIVER PERFORMANCE AND DRIVER/VEHICLE/ENVIRONMENT INTERACTION**

National Hwy. Traf. Safety Administration, N19900  
C. H. HartmenA. N. Konaratos  
In HS-012 507

## Field 3—HUMAN FACTORS

HSL 73, No. 09

### Group 3D—Driver Behavior

\*Driver vehicle road interfaces, \*Driver performance, \*Safety research, \*Environmental factors, \*Alcohol usage deterrents, \*Vehicle design, \*Human factors, \*Field of view, \*Vision, \*Driver education,

The continual interactive process between the driver, the vehicle, and the environment in a traffic situation is discussed. The strong informational and mechanical links between man, vehicle, and environment are indicated. Several ways to improve driver performance are outlined, including research and development activities underway to support alcohol countermeasure efforts, driver education programs, as well as licensing and enforcement. Pertinent research involving both human capability and vehicle hardware improvements is identified. Attention is also focused on driver-environment interaction. Representative research and experimentation projects in this context are identified and briefly described.

HS-012 523

### SAFETY PRIORITIES OF THE FUTURE--DRIVER CONTROL PROGRAM

Department of Transp., D17400  
Jr., B. O. Davis  
In HS-012 507

\*Driver behavior, \*Problem drivers, \*Driver improvement, \*Driver rehabilitation, \*Driver licensing, \*Alcohol Safety Action Projects, \*Traffic law enforcement, \*Drinking drivers,

Three driver improvement programs of the federal government are discussed. Top priority has been given to the Alcohol Countermeasures Program. Presently, 35 federally-funded Alcohol Safety Action Projects designed to find effective and lasting cures to the drunk driver problem, are in operation throughout the country. The Driver Control Program still in its formative stage, will encompass: the driver licensing and relicensing processes; driver improvement including rehabilitation and retraining; administrative system of driver referrals; administrative adjudication of traffic law violations; and various types of enforcement actions. This program seeks to restructure driver behavioral patterns. The third driver improvement program is STEP-Selective Traffic Enforcement Programs, a model project to demonstrate traffic enforcement countermeasures that will result in accident reductions and identify the kind of enforcement action needed to have a meaningful impact on accident statistics.

HS-012 536

### MOBILITY WITH SAFETY

International Road Federation, I44400 Minnesota Mining and Mfg. Co., M48000  
For primary bibliographic entry see Fld. 2D.  
HS-012 538

### SAFETY PRIORITIES OF THE FUTURE--THE DRIVER

Automobile Manufacturers Assoc. Inc., A80400  
For primary bibliographic entry see Fld. 3F.  
HS-012 539

### DRIVERS INVOLVED IN FATAL PEDESTRIAN COLLISIONS

Johns Hopkins Univ., J03600 Maryland Office of the Chief Medical Examiner, M07800 Insurance Inst. for Hwy. Safety, I36000  
For primary bibliographic entry see Fld. 3K.

HS-012 543

### OVERTAKING IN THE DARK AND IN DAYLIGHT

Central Organization for Traf. Safety in Finland, C34950  
R. KaukinenTALJA-12  
Corporate author

\*Overtaking, \*Passing, \*Day vs night accident risks, \*Driver performance, \*Gap utilization, \*Judgment, \*Risk taking, \*Driver errors, \*Driver experience, \*Age factor in driving, \*Marital status, \*Driver vehicle familiarity, \*Automobile power, \*Variance analysis, \*Male drivers, \*Road tests, \*Day vs night performance,

Thirty male drivers were tested in the dark in winter and 31 in daylight in summer. The driver was required to indicate to the test instructor the last moment he considered himself able to start passing the vehicle ahead without colliding with an oncoming vehicle. When the speed of the oncoming vehicle was higher than that of the vehicle ahead the number of erroneous judgments was largest. At least one erroneous judgment, which theoretically would have resulted in a collision with the oncoming vehicle, was made by 60% if the drivers in the dark and 74% in daylight. Fewer errors were made by drivers with powerful vehicles and by married drivers. Experienced drivers made fewer errors in daylight but experience had no influence on nighttime judgment. Older drivers made more erroneous judgments in the dark than younger drivers but in daylight the result was opposite.

HS-012 561

### A STUDY OF ACCIDENT RATES AMONGST MOTORISTS WHO PASSED OR FAILED AN ADVANCED DRIVING TEST

Transport and Road Res. Lab. (England), T33900  
For primary bibliographic entry see Fld. 3F.  
HS-012 563

### BEHAVIOR MODIFICATION AS A COUNTERMEASURE FOR THE DRINKING DRIVER

For primary bibliographic entry see Fld. 3A.  
HS-012 565

### PSYCHOPHYSIOLOGICAL MEASURES OF DRIVERS UNDER ACTUAL DRIVING CONDITIONS

v4 n4  
J. D. BrownW. J. Huffman  
See serial citation

\*Male drivers, \*Heart rate, \*Eye movements, \*Galvanic skin response, \*Acceleration, \*Braking, \*Steering, \*Day vs night performance, \*Driving conditions, \*Road tests, \*Driver records, \*Driver reaction time,

Thirty-two male subjects, 16 with good driving records and 16 with poor driving records, were tested on heart, lateral eye movement, and galvanic skin response rates, as well as accelerator reversal, brake response, and steering wheel reversal rates. They were tested in four traffic conditions: residential driving; rural, two lane highway driving; four lane expressway driving; and four lane business district driving. The good record drivers had significantly lower mean rates of galvanic skin responses, accelerator reversals, and brake responses than the poor record drivers. Among the four traffic conditions, significant differences occurred for all measures except heart rate.

Lateral eye movement and brake response rates were highest for residential driving; galvanic skin response rate was lower for rural driving than for the other three traffic conditions; accelerator reversal rates were higher for residential driving; steering wheel reversals were higher for rural and expressway driving.

HS-012 570

### ROAD TESTS OF ALERTNESS VARIABLES. FINAL REPORT

Calspan Corp., C23600

R. C. Sugarman C. P. Cozad ZM-5019-B-1

Continues studies initiated under contract FH-11-7313.

NTIS

\*Vigilance tests, \*Driver performance, \*Attention lapses, \*Road tests, \*Driving simulation, \*Driving task analysis, \*Driver emergency responses, \*Noise tolerances, \*Automatic speed control, \*Driver fatigue, \*Driver mileage, \*Driver errors, \*Biomedical monitoring, \*Electrocardiography, \*Heart rate, \*Steering reversals, \*Instrumented vehicles, \*Tracking, \*Design of experiments, \*Data reduction, \*Driver monitoring, \*Electroencephalography,

An on-road validation of a previous study of factors affecting driver alertness was conducted using a driving simulator to investigate the effects of driving time, acoustic noise, and task complexity on driver performance in a closely duplicated low-event, long-duration driving environment. Lateral road position error significantly increased as a function of time, as did the occurrence of the alpha rhythm in the electroencephalogram (EEG). The number of small (2 deg.) steering wheel reversals also tended to decrease as time progressed. Use of an automatic speed controller fostered decreases in alertness, as evidenced by changes in heart rate and the theta EEG component. Loud, continuous noise acted as a stressful stimulus—physiological measure indicated high arousal, while a performance measure showed higher error scores than shown at lower noise levels. A multiple regression analysis to develop an advanced index of driver alertness is recommended.

HS-800 790

### 3F. Driver Licensing

#### THE DEVELOPMENT AND EVALUATION OF ACCIDENT COUNTERMEASURES IN DRIVER LICENSING AGENCIES

California Dept. of Motor Vehicles, C03000

R. S. Coppin R. C. Peck

In HS-012 507

\*Accident prevention, \*Driver improvement, \*Driver licensing, \*Benefit cost analysis, \*Program evaluation, \*Systems analysis, \*Problem drivers, \*Driver records, \*Models, \*Accident risks,

Some conceptual models and designs for developing better licensing programs and driver-oriented accident countermeasures are outlined. Statistics and studies are cited to show that wholesale removal of the worst drivers (accident and violation repeaters) would only have a limited impact on the total accident problem. Emphasis is placed on the need for sound evaluation procedures including detailed conceptual analyses, randomized treatment assignment, control groups, very large

sample sizes, and valid criterion measures. The cost-benefit approach to program development and countermeasure allocation is recommended.

HS-012 521

#### SAFETY PRIORITIES OF THE FUTURE--DRIVER CONTROL PROGRAM

Department of Transp., D17400

For primary bibliographic entry see Fld. 3D.

HS-012 536

#### SAFETY PRIORITIES OF THE FUTURE--THE DRIVER

Automobile Manufacturers Assoc. Inc., A80400

F. M. Kreml

In HS-012 507

\*Driver licensing, \*Driver education, \*Driver license restrictions, \*Driving without a license,

Human factors research must be undertaken to better define skills and capacities needed in modern day traffic as a base for new approaches to driver training and licensing. Recommendations are made for issuance of limited licenses and for new licensing practices which reflect a driver's level of competency. Special attention should be paid to identifying drivers without valid licenses.

HS-012 539

#### A STUDY OF ACCIDENT RATES AMONGST MOTORISTS WHO PASSED OR FAILED AN ADVANCED DRIVING TEST

Transport and Road Res. Lab. (England), T33900

F. Hoinville R. Berthoud A. M. Mackie TRRL-LR-499

Corporate author

\*Accident rates, \*Driver tests, \*Accident risk forecasting, \*Accident records, \*Driver behavior, \*Driver experience, \*Vehicle classification, \*Automobile power, \*Driver attitudes, \*Driver age, \*Driver sex, \*Driver occupation, \*Driver residence, \*Driver mileage, \*Night driving, \*Vehicle age, \*Trip purpose, \*England, \*Regression analysis, \*Questionnaires, \*Multivariate analysis, \*Automobile maintenance,

This study measures the extent that a driving test can be used to predict subsequent accident records of those drivers who pass or fail it. The prediction of accidents for groups of drivers through knowledge of other driver characteristics is also examined. Results indicate that the group of motorists who passed the test has 25% fewer accidents over the three year period after taking the test than those who failed. This demonstrates quantitatively that driver testing by subjective methods can successfully identify a group of drivers who will have more accidents. Multivariate analysis was applied to the various characteristics measured in the survey to find whether the identification of drivers with future good or bad accident records can be made more reliable. The relevance to testing in general is discussed.

HS-012 563

## Group 3H—Environmental Effects

## 3H. Environmental Effects

## ROAD TESTS OF ALERTNESS VARIABLES. FINAL REPORT

Calspan Corp., C23600

For primary bibliographic entry see Fld. 3D.

HS-800 790

## 3K. Pedestrians

## THE PEDESTRIAN SAFETY PROJECT IN THE CCMS ROAD SAFETY PILOT STUDY

Fonds d'Etudes et de Recherches pour la Secur ity Routiere (Belgium), F18000

J. P. DeCoster

In HS-012 507

\*Pedestrian safety, \*Accident statistics, \*Fatality rates, \*Injury rates, \*Accident severity, \*Pedestrian age, \*Age factor in accidents, \*Questionnaires, \*Accident risks, \*International factors, \*Accident types,

The design of a questionnaire to obtain information for the Committee on the Challenges of Modern Society's pedestrian safety project is discussed. The questionnaires will be filled out by member countries and after an analysis of the response it is hoped that a set of recommendations to improve pedestrian safety can be drawn up. The questionnaire covers six broad aspects of pedestrian safety: statistics, psychology, urbanism, local planning, vehicles, and special risks. The content of each of these areas is summarized. Accident statistics for 1970 based on a survey carried out in N.A.T.O countries are presented including total fatalities and injuries for each country; percentage of fatalities and injuries by type of road user; accident severity per road user; death risk coefficient for pedestrians by age, and accident risk coefficient for pedestrians by age.

HS-012 529

## DRIVERS INVOLVED IN FATAL PEDESTRIAN COLLISIONS

Johns Hopkins Univ., J03600 Maryland Office of the Chief Medical Examiner, M07800 Insurance Inst. for Hwy. Safety, I36000

S. P. Baker L. S. Robertson B. O'Neill

Presented at the American Assoc. for Automotive Medicine annual meeting (16th), Chapel Hill, 19 Oct 1972.

In HS-012 859

\*Pedestrian fatalities, \*Vehicle pedestrian collisions, \*Negligence, \*Driver behavior, \*Driver records, \*Traffic law violations, \*Driver license suspension, \*Drinking drivers, \*Baltimore, \*High risk drivers, \*Convictions, \*Alcohol chemical tests, \*Accident prevention,

Drivers involved in 180 fatal collisions with Baltimore pedestrians were studied. Eighty-three drivers (46%) were judged to have been probably negligent and 66 (37%) were probably not negligent; negligence was not known for 31 (17%). Driver negligence was correlated with poor driving records. The study drivers had more points for traffic convictions than the average Maryland driver. Recommendations include chemical tests for alcohol of drivers who kill pedestrians and swifter suspension of licenses of drivers believed to pose a substantial hazard to

society. Since behavior of high-risk drivers may prove to be as difficult to modify as that of high-risk pedestrians, solutions probably lie in modifying roads, vehicles, and traffic patterns in order to reduce pedestrian injuries and deaths.

HS-012 543

## 4. OTHER SAFETY-RELATED AREAS

## 4A. Codes And Laws

## LAWS REGULATING OFF-HIGHWAY VEHICLES

National Com. on Uniform Traf. Laws and Ordinances, N14400

For primary bibliographic entry see Fld. 5T.

HS-800 787

## 4B. Community Support

## PLANNING OF SAFETY PROGRAMS--HIGHWAY

Jorgensen (Roy) Associates, Inc., J08400

R. E. Jorgensen

In HS-012 507

\*Federal state relationships, \*Highway safety programs, \*Federal role, \*State government, \*Local government, \*Highway departments, \*Planning,

The present hierarchical structure for planning highway safety programs is outlined and evaluated. Congress has established goals and objectives and provided for reports of accomplishment towards those objectives. The Department of Transportation, through the Federal Highway Administration and National Highway Traffic Safety Administration has issued standards and manuals in carrying out its planning responsibilities, and has provided for evaluation of accomplishments. At the state and local levels in the hierarchical structure, the planning process falters. The need for more delegation of planning responsibility and quantitative evaluation by state agencies is indicated. It is suggested that a new safety standard for program administration and evaluation impose basic policy requirements for existing responsible state agencies. It is also suggested that highway maintenance supervisors be incorporated into the highway safety planning process.

HS-012 516

## THE IMPLEMENTATION OF DRIVER AND VEHICLE SAFETY PROGRAMS--EVERYBODY'S JOB

Delaware Office of the Secretary of Public Safety, D08800

F. W. Vetter, Jr.

In HS-012 507

\*Safety program effectiveness, \*Community support, \*Community goals, \*Public opinion, \*Driver attitudes, \*Human factors engineering, \*Highway safety programs, \*Delaware,

Factors which hinder implementation of effective highway safety programs are discussed. It is concluded that the future success of highway safety programs will require a clear mandate from the public, as well as greatly accelerated work in the fields of human engineering, better data on which to justify allocation of resources, and improved means of communicating.

HS-012 519

# **TRAFFIC WEEK AT KOUVOLA IN 1968. AN INVESTIGATION INTO THE EFFECTS OF A TRAFFIC WEEKTYPE EDUCATION AND COMMUNICATION CAMPAIGN**

Central Organisation for Traf. Safety in Finland, C34950  
V. AholaK. EklundU. LeppanenL. OranenTALJA-13  
Corporate author

\*Safety campaigns, \*Safety program effectiveness, \*Safety education, \*Child safety education, \*Pedestrian education, \*Program evaluation, \*Driver behavior, \*Pedestrian behavior, \*Mass media, \*Driver attitudes, \*Interviews, \*Bicycle riders, \*Finland, \*Surveys,

Residents of Kouvola and the neighboring town of Torssa were surveyed, traffic in these towns was observed, and traffic knowledge of licensed drivers, pedestrians, bicycle and moped riders, and schoolchildren was tested a month before, during, a week after, and nearly two months after the traffic week. Mass media played a strong part in the communications process. Short term changes and improvements in attitudes, driver and pedestrian behavior, and traffic knowledge were observed at Kouvola. The traffic week was found to have little effect on the residents of Torssa. It is suggested that traffic weeks be conducted on a local rather than a national level.

HS-012 562

## **SELECTIVE TRAFFIC ENFORCEMENT PROGRAM PLANNING GUIDE. REV. ED.**

National Hwy. Traf. Safety Administration, N19900  
For primary bibliographic entry see Fld. 2H.  
HS-820 210

### **4C. Cost Effectiveness**

#### **THE EVALUATION OF HIGHWAY SAFETY PROGRAMS**

England Dept. of the Environment, E08100  
D. Holmes  
In HS-012 507

\*Benefit cost analysis, \*Program evaluation, \*Highway safety programs, \*Safety program effectiveness, \*Traffic management, \*Highway improvements, \*Great Britain,

Benefit cost analysis is shown to be valuable means of determining the best allocation of resources for highway safety programs. Funds from all sources should be treated as equivalent and potential safety measures should be competitive. Changes in the environment, notably by minor road improvements, can yield relatively large safety benefits, if they are founded on thorough investigation. Traffic management and changes in urban layout can also pay safety dividends if properly planned.

HS-012 520

#### **CUMULATIVE REGULATORY EFFECTS ON THE COST OF AUTOMOTIVE TRANSPORTATION**

Ad Hoc Com. on the Cumulative Regulatory Effects on the Cost of Automotive Transp., A05040  
L. A. Goldmuntz  
In HS-012 507

\*Benefit cost analysis, \*Automobile costs, \*Air pollution control costs, \*Automobile prices, \*Emission control, \*Vehicle air pollution, \*Air pollution damage assessment, \*Air bag restraint systems, \*Safety device costs, \*Restraint system effectiveness, \*Exhaust emission control,

Findings of the Committee on the Regulatory Effects on the Cost of Automotive Transportation (RECAT), regarding emission control and occupant protection systems, are reported. The RECAT Committee was created to assess the costs and benefits of the various regulatory programs. The Committee concluded that the cost of safety standards and emission control would add \$873 to the retail price of automobiles by 1976. The Committee estimated the benefits to be obtained from these regulations and concluded that in the decade of 1976-85 the excess of emission control costs over benefits would average \$63 billion. Furthermore, it was estimated that the use of the air bag in both front and rear seats would involve in the same decade an excess cost with respect to a possible alternative of approximately \$30 billion. Thus under present regulations, the consumer will be obliged to expend approximately \$90 billion during 1976-85 more than alternative cost beneficial strategies might suggest.

HS-012 540

#### **NATIONAL CONFERENCE ON RAILROAD-HIGHWAY GRADE CROSSING SAFETY, PROCEEDINGS, AUGUST 29-31, 1972**

Department of Transp., D17400 Highway Res. Board, H09600  
National Safety Council, N25800  
For primary bibliographic entry see Fld. 2I.  
HS-012 557

#### **ROADWAY DELINEATION SYSTEMS**

Pennsylvania State Univ., P07800 Institute for Res., I29400  
For primary bibliographic entry see Fld. 2I.  
HS-012 572

### **4D. Governmental Aspects**

#### **THE WORLDWIDE NEED FOR VEHICLE AND HIGHWAY SAFETY: UNITED STATES VIEWPOINT**

Department of Transp., D17400  
For primary bibliographic entry see Fld. 2.  
HS-012 509

#### **THE WORLDWIDE NEED FOR VEHICLE AND HIGHWAY SAFETY: INTERNATIONAL STANDARDS**

INTERNATIONAL ROAD FEDERATION, I44400  
For primary bibliographic entry see Fld. 2.  
HS-012 511

#### **PLANNING OF SAFETY PROGRAMS--HIGHWAY**

Jorgensen (Roy) Associates, Inc., J08400  
For primary bibliographic entry see Fld. 4B.  
HS-012 516

#### **PLANNING OF SAFETY PROGRAMS--DRIVER/VEHICLE**

Canada Ministry of Transport, C26000  
G. D. Campbell  
In HS-012 507

## Field 4—OTHER SAFETY-RELATED AREAS

HSL 73, No. 09

### Group 4D—Governmental Aspects

\*Safety program effectiveness, \*Program evaluation, \*Alcohol laws, \*Canada, \*Public information programs, \*Planning, \*Federal role, \*Vehicle safety,

This paper investigates three important elements of the planning function: objective setting, communication, and evaluation design. Two major pieces of Canadian Federal legislation, the Motor Vehicle Safety Act and the breathalyzer legislation are briefly described. These legislative countermeasures, one directed at the vehicle and one at the driver, are used to illustrate the importance of these planning elements.

HS-012 517

### SAFETY PRIORITIES OF THE FUTURE--FOR A RATIONAL APPROACH OF THE ROAD SAFETY PROBLEM

Belgium Ministry of Transport and Communications, B06700  
J. Vrebos  
In HS-012 507

\*Program evaluation, \*Highway safety programs, \*Safety program effectiveness, \*Systems analysis, \*Priorities, \*Decision making, \*Planning, \*International factors, \*Federal role,

The value of the Planning-Programming-Budgeting System, systems analysis, and objective-program matrices in determining road safety program priorities, is discussed. N.A.T.O. and the Commission of the European Communities' road safety priority areas are listed.

HS-012 535

### NATIONAL CONFERENCE ON RAILROAD-HIGHWAY GRADE CROSSING SAFETY, PROCEEDINGS, AUGUST 29-31, 1972

Department of Transp., D17400. Highway Res. Board, H09600  
National Safety Council, N25800  
For primary bibliographic entry see Fld. 2I.  
HS-012 557

### 4E. Information Technology

### SPECIFICATIONS OF PRODUCTS AND SERVICES FOR THE NATIONAL HIGHWAY ACCIDENT AND INJURY ANALYSIS CENTER

Systems Devel. Corp., S62500  
TM- (L)-4113/001/00

Part 2 of this report is Interim Report on Analysis and Design of Long Range National Highway Safety Data System, TM- (L)-4113/000/00.  
NTIS

\*Information system design, \*Systems analysis, \*Data banks, \*Data processing, \*Systems engineering, \*Data acquisition, \*Information retrieval, \*Algorithms, \*Data analysis, \*Computerized records management, \*Flow charts, \*National Highway Safety Bureau,

Forty-nine specific products and services to be provided by a long range national highway safety data system and 21 specific National Highway Safety Bureau user organizations are identified, and the applicability of each product or service to each user organization is indicated. Twenty-one data base areas needed to support the products and services are defined and the

types of sources of data are identified for each data base area. System capabilities required to process the data to provide the products and services are also indicated. The results of preliminary efforts on this contract which included the establishment of a conceptual framework for analysis of the required products and services of the data system, preparation of a set of potential products and services, and a preliminary analysis of the software, hardware, costs, and operational characteristics of the long range system, as well as identification of two alternative paths of system evolution and the policy implications of each, are included.

HS-800 147

### 4G. Mathematical Sciences

### THE DEVELOPMENT AND EVALUATION OF ACCIDENT COUNTERMEASURES IN DRIVER LICENSING AGENCIES

California Dept. of Motor Vehicles, C03000  
For primary bibliographic entry see Fld. 3F.  
HS-012 521

### THE ESTIMATION OF ACCIDENT IMPACT SPEED

Cornell Aeronautical Lab., Inc., C67200  
For primary bibliographic entry see Fld. 1C.  
HS-012 558

### ZUR STABILITÄT DER KURVENFAHRT EINES KRAFTFAHRZEUGES MIT UND OHNE TANGENTIALBESCHLEUNIGUNG (ON THE STABILITY OF TURNS OF A MOTOR VEHICLE WITH AND WITHOUT TANGENTIAL ACCELERATION)

For primary bibliographic entry see Fld. 5R.  
HS-012 566

### SKID PREDICTION

For primary bibliographic entry see Fld. 5A.  
HS-012 567

### DYNAMICS OF PNEUMATIC TIRE VEHICLES WITH CONNECTED SUSPENSION SYSTEMS

For primary bibliographic entry see Fld. 5R.  
HS-012 568

### TRACTOR-SEMITRAILER DYNAMICS: DESIGN OF THE FIFTH WHEEL

For primary bibliographic entry see Fld. 5T.  
HS-012 569

### IMPROVED CRITERIA FOR TRAFFIC SIGNAL SYSTEMS IN URBAN NETWORKS

Planning Res. Corp., P24600 Voorhees (Alan M.) and Associates, Inc., V18600  
For primary bibliographic entry see Fld. 2I.  
HS-012 571

### RUBBER STRUCTURE AND PROPERTIES

For primary bibliographic entry see Fld. 5V.  
HS-012 574

**FRICTION OF RUBBER**

Michigan Univ., M36000  
For primary bibliographic entry see Fld. 5V.  
HS-012 575

**TIRE CORD STRUCTURE AND PROPERTIES**

Massachusetts Inst. of Tech., M15000  
For primary bibliographic entry see Fld. 5V.  
HS-012 576

**RECENT DEVELOPMENTS WITH TIRE CORDS AND CORD-TO-RUBBER BONDING**

Toray Industries, Inc. (Japan), T25500  
For primary bibliographic entry see Fld. 5V.  
HS-012 577

**PROPERTIES OF CORD-RUBBER LAMINATES**

Michigan Univ., M36600  
For primary bibliographic entry see Fld. 5V.  
HS-012 578

**STRUCTURE OF THE TIRE**

For primary bibliographic entry see Fld. 5V.  
HS-012 579

**TIRE STRESS AND DEFORMATION**

Firestone Tire and Rubber Co., F12600  
For primary bibliographic entry see Fld. 5V.  
HS-012 580

**THE CONTACT BETWEEN TIRE AND ROADWAY**

Michigan Univ., M36600  
For primary bibliographic entry see Fld. 5V.  
HS-012 581

**SKID RESISTANCE AND DIRECTIONAL CONTROL**

Natural Rubber Producers' Res. Assoc., Inc. (England), N30800  
For primary bibliographic entry see Fld. 5V.  
HS-012 582

**THE TIRE AS A VEHICLE COMPONENT**

Technische Hogeschool, Delft (Netherlands), T08100  
For primary bibliographic entry see Fld. 5V.  
HS-012 583

**ROAD TESTS OF ALERTNESS VARIABLES. FINAL REPORT**

Calspan Corp., C23600  
For primary bibliographic entry see Fld. 3D.  
HS-800 790

**5. VEHICLE SAFETY****INTERNATIONAL VEHICLE AND HIGHWAY SAFETY CONFERENCE, MAY 30--JUNE 2, 1972, WASHINGTON, D.C. PROCEEDINGS**

Society of Automotive Engineers, Inc., S21600  
For primary bibliographic entry see Fld. 2.  
HS-012 507

**THE WORLDWIDE NEED FOR VEHICLE AND HIGHWAY SAFETY: EUROPEAN VIEWPOINT**

Belgium Ministry of Transport and Communications, B06700

For primary bibliographic entry see Fld. 2.  
HS-012 508

**5A. Brake Systems****COMMERCIAL MOTOR VEHICLE BRAKING, SPECIAL STUDY**

National Transp. Safety Board, N30000  
NTSB-HSS-72-5  
Corporate author

\*Truck brakes, \*Disc brakes, \*Hydraulic brakes, \*Antiskid brakes, \*Brake performance, \*Energy absorption, \*Brake systems design, \*Tire pavement interface,

Requirements are discussed in relation to the need for a systems analysis approach to reduce the braking incompatibility of passenger cars and commercial vehicles. The need for faster acting and properly timed application systems, coupled with the marginal energy-absorption capability of the foundation brake and the inherent variables resulting from differences in tire-to-road unit loads are advanced as arguments to support a new approach to the overall problem. The study suggests that consideration be given to incorporating hydraulically actuated, anti-skid, disc-type brakes with a supplemental energy absorption system in commercial vehicle brake designs.

HS-012 506

**SKID PREDICTION**

V1 N2  
H. OuwerkerkR. R. Guntur

\*Skidding, \*Antiskid brakes, \*Antilocking devices, \*Forecasting, \*Skid control, \*Wheel slip control, \*Controlled slip differentials, \*Speed, \*Braking forces, \*Brake torque, \*Deceleration detection, \*Mathematical analysis, \*Tire road interface, \*Wheel locking friction, \*Vehicle stability, \*Modulators, \*Sensors, \*Equations of motion, \*Braking 14See serial citation,

The components and operation of existing antiskid devices, such as antiskid brakes and antilocking devices are reviewed. Three methods of skid prediction are mathematically presented and their merits and demerits studied. It is shown that the prediction point slip depends on the speed of the wheel at the beginning of the brake cycle, the rate of application of the brake torque, the condition which is employed for the purpose of prediction, and threshold value of the parameter that is used in formulating the condition for prediction.

HS-012 567

**5B. Buses, School Buses, And Multipurpose Passenger Vehicles****MINIMUM REQUIREMENTS FOR SCHOOL BUS CONSTRUCTION AND EQUIPMENT REGULATION VESC-6. REV ED**

Vehicle Equipment Safety Commission, V01800  
VESC-6  
Corporate author

\*School bus design, \*School bus standards, \*Regulations, \*School bus bodies, \*School bus chassis, \*Electric system design, \*Emergency equipment, \*School bus safety,



Standards for the construction and equipping of school buses manufactured after October 1, 1972 are presented. Areas covered by specific standards include: body construction, chassis requirements, electrical system requirements, and equipment requirements.  
HS-012 542

**SCHOOL BUS SAFETY: A LESS THAN PASSING GRADE?**

V64 N9

T. Tomlinson

See serial citation

\*School bus accidents, \*Accident investigation, \*Accident causes, \*Accident case reports, \*Accident factors, \*Injury causes, \*Accident research, \*School bus safety, \*Multidisciplinary teams, \*School bus design, \*Driver error caused accidents,

A study conducted by the UCLA Trauma Research Group on school bus accidents is reviewed. Research and investigation procedures employed in the study are briefly discussed and findings regarding some of the accidents investigated are presented. Recommendations for reducing school bus accident and injury potential are included.

HS-012 554

**SAFETY AND THE YELLOW BUS**

T. Tomlinson

Automobile Club of Southern California

\*School bus accidents, \*Accident investigation, \*Accident causes, \*Accident case reports, \*Accident factors, \*Injury causes, \*Accident research, \*School bus design, \*Multidisciplinary teams, \*School bus safety, \*Driver error caused accidents, \*Injury severity, \*Seat design,

This report reviews a study conducted by the UCLA Trauma Research Group on school bus accidents. Research and investigation procedures employed in the study are briefly discussed and findings regarding some of the accidents investigated are presented. Recommendations for reducing school bus accident and injury potential are included.

HS-012 555

**5C. Cycles**

**SOME EPIDEMIOLOGIC FEATURES OF MOTORCYCLE INJURY IN A CALIFORNIA COMMUNITY. PRELIMINARY REPORT**

California Univ., Davis, C14800

For primary bibliographic entry see Fld. 1B.

HS-012 556

**5D. Design**

**UK VIEW OF THE RELATIVE IMPORTANCE OF ROAD SAFETY FEATURES**

England Dept. of the Environment, E08100

For primary bibliographic entry see Fld. 2D.

HS-012 512

**AUTOMOBILE SAFETY IN THE EUROPEAN COMMUNITY 04P. Schlosser**

Commission of the European Communities, C56300

In HS-012 507

\*Intergovernmental relations, \*Vehicle safety standards, \*Accident statistics, \*Accident rates, \*Specifications, \*Regulations, \*Injury rates, \*Fatality rates, \*Vehicle design, \*World government, \*Quality control, \*Safety devices, \*Urban accidents, \*Rural accidents,

The Commission of European Communities' (C.E.C.) role in improving vehicle safety is discussed. Directives already adopted by the Commission's Council of Ministers involve type approval of motor vehicles and trailers; permissible motor vehicle noise level and exhaust systems; rear license plates; liquid fuel tanks and rear protection devices; vehicle warning signals; pollution from gasoline engines; steering systems; door systems; and braking systems. A list of proposed directives is included. Accident statistics of C.E.C. countries for 1970 are also briefly reviewed.

HS-012 513

**THE ACTIVITY OF THE GROUP OF EXPERTS ON THE CONSTRUCTION OF VEHICLES (WP 29) FOR MOTOR VEHICLE SAFETY**

Italy Ministry of Transport and Civil Aviation, I53150

G. Pocchi

In HS-012 507

\*Design standards, \*Vehicle design, \*Standardization, \*Intergovernmental relations, \*Vehicle safety standards, \*Regulations, \*International factors, \*Safety design,

The group of experts on the construction of vehicles (WP 29), and ad hoc committee of the United Nation's Economic Commission for Europe, consists of representatives of 24 European and extra-European countries, as well as numerous international specialized organizations. The activities of WP 29 are presented. The group studied and elaborated numerous design and safety regulations and resolutions of international value regarding vehicle construction and equipment characteristics.

HS-012 514

**PLANNING OF SAFETY PROGRAMS-- DRIVER/VEHICLE**

Canada Ministry of Transport, C26000

For primary bibliographic entry see Fld. 4D.

HS-012 517

**IMPROVED DRIVER PERFORMANCE AND DRIVER/VEHICLE/ENVIRONMENT INTERACTION**

National Hwy. Traf. Safety Administration, N19900

For primary bibliographic entry see Fld. 3D.

HS-012 523

**EXPERIMENTAL SAFETY VEHICLES**

National Hwy. Traf. Safety Administration, N19900

J. A. Edwards

In HS-012 507

\*Experimental automobiles, \*Safety cars, \*Crashworthiness,  
\*Automobile design, \*International factors,

An overview of the objectives and goals of NHTSA's Experimental Safety Vehicle (ESV) Program is presented, as well as a description of the initial ESV project, the family sedan. The international ESV program is summarized and future plans for the ESV program are briefly outlined.

HS-012 534

#### **MOBILITY WITH SAFETY**

International Road Federation, I44400 Minnesota Mining and Mfg. Co., M48000

For primary bibliographic entry see Fld. 2D.

HS-012 538

#### **VISIBILITY: A COUNTERPROPOSAL**

For primary bibliographic entry see Fld. 5M.

HS-012 547

#### **DOT'S FOUR-POINT PROGRAM TO REDUCE TRUCK NOISE**

Department of Transp., D17400

For primary bibliographic entry see Fld. 2G.

HS-012 549

#### **SAFETY, NOISE, AND EMISSIONS STRESSED IN NEW BRITISH VEHICLES**

For primary bibliographic entry see Fld. 2G.

HS-012 550

#### **DESIGNS FOR SAFETY: THE MECHANICAL FUSE**

V94 N4

M. C. Shaw

See serial citation

\*Energy absorbing systems, \*Energy absorption, \*Metal cutting, \*Shock tubes, \*Energy conversion, \*Deformation,

Two energy absorbing devices, metal cutting and tube-pleating are described. Both devices safely and irreversibly convert crash energy to heat by metal-working processes performed on replaceable mechanical fuses made of inexpensive pieces of tubing.

HS-012 553

#### **5F. Fuel Systems**

##### **CUMULATIVE REGULATORY EFFECTS ON THE COST OF AUTOMOTIVE TRANSPORTATION**

Ad Hoc Com. on the Cumulative Regulatory Effects on the Cost of Automotive Transp., A05040

For primary bibliographic entry see Fld. 4C.

HS-012 540

##### **EMISSION CONTROL DEVICE TAKES LEADED FUELS IN STRIDE**

V44 N1

See serial citation

\*Exhaust emission control devices, \*Catalytic converters, \*Thermal reactors, \*Oxidation, \*Fuel economy, \*Leaded gasoline, \*Exhaust emission standards, \*Reverter,

The three-stage Reverter developed by the Questor Corp. is described. Testing of this new exhaust emissions control system resulted in 0.07 gram/vehicle mile hydrocarbon emissions compared with an allowable 0.41 by 1975 standards; 2.8 gram/vehicle mile carbon monoxide emissions compared with an allowable 3.4 for 1975; and 0.26 gram/vehicle mile nitrogen oxides against an allowable 0.4 by the 1976 standard. The major drawback in this system is a 15% reduction in fuel economy, however further engineering development may be able to reduce this to 5% to 10%.

HS-012 548

#### **SAFETY, NOISE, AND EMISSIONS STRESSED IN NEW BRITISH VEHICLES**

For primary bibliographic entry see Fld. 2G.

HS-012 550

#### **MOTOR GASOLINES, SUMMER 1972**

Bureau of Mines, B31200

E. M. Shelton Petroleum-Products-S

Corporate author

\*Fuel properties, \*Gasoline, \*Fuel analysis, \*Octane ratings, \*Gasoline quality, \*Fuel composition,

The properties of motor fuels sold through service stations in the United States are reported in accordance with a cooperative agreement between the American Petroleum Institute and the Bureau of Mines. This report presents analytical data for 5,164 samples that represent the products of 57 companies. Company representatives collected the samples during June, July, and August 1972. Information presented in tabular format includes a summary of the characteristics of motor gasolines for summer 1971 and 1972; trends of some of the more important characteristics for several years; trends of national average octane numbers during recent years; regional average octane numbers of regular and premium price fuels; and data for third grade, intermediate grade, and super-premium gasolines.

HS-012 559

#### **5I. Inspections**

##### **MOTOR VEHICLE INSPECTION PROJECT**

West Germany Federal Ministry of Transport, W13400

E. Huttebraucker

In HS-012 507

\*Vehicle inspection, \*Benefit cost analysis, \*Failure caused accidents, \*Inspection procedures, \*International factors, HS-012 532

#### **5J. Lighting Systems**

##### **MONETARY VALUE DRIVERS PLACE ON COMFORT IN NIGHT DRIVING. FINAL REPORT**

Federal Hwy. Administration, F06000

R. N. SchwabD. SolomanJ. F. LyonsFHWA-RD-72-14; PB-21 NTIS

\*Headlamp glare, \*Night driving, \*Comfort, \*Driver age, \*Consumer preferences, \*Polarized headlamps, \*Low beamed headlamps, \*Driver attitudes, \*Driver characteristics, \*Test tracks, \*Glare tolerances, \*Lighting equipment costs, \*High beamed headlamps,

B5

## Group 5J—Lighting Systems

The amount drivers are willing to pay for additional comfort resulting from a substantial decrease in glare from oncoming headlamps is reported. While driving on a loop test track at night with controlled exposure to oncoming traffic, 24 drivers were required to choose between three headlighting systems with varying monetary values subtracted from their pay. The headlighting systems included a high glare system—conventional high beams, and two low glare systems—conventional low beams and high intensity polarized beams. Results of the study show that drivers over age 47 were willing to pay mean value of 23 to 40 cents per hour for low glare headlights when a high glare system was free. Drivers under age 29, who were less sensitive to the effects of glare, were willing to pay only 13 to 16 cents per hour. These amounts approximate the estimated cost of a polarized headlighting system which would produce the additional comfort and visibility.

HS-012 544

## 5M. Mirrors And Mountings

## VISIBILITY: A COUNTERPROPOSAL

v9 n3

T. Grey

See serial citation

\*Rear visibility, \*Periscopic rearview mirrors, \*Automobile design, \*Blind spots, \*Federal control, \*Body design, \*Mirror positioning, \*Convex mirrors, \*Interior rearview mirrors, \*Rear windows, \*Pillars, \*Ford Motor Co., \*Wide angle rearview mirrors, \*Automobile safety standards,

Automobile manufacturers oppose the use of rooftop periscopes which may be required by a federal standard for unobstructed rear visibility in 1976 model cars, because periscopes are costly, unattractive and do not eliminate blind spots. Ford Motor Co. has written a counter proposal for a non-periscope visibility system which suggests that some present body styles be redesigned and window pillars narrowed for improved visibility. Convex mirrors, wider interior mirrors, step-type inside mirrors, and flip mirrors made up of several flat reflecting surfaces which tilt together when the driver touches a button, enabling him to scan a wide area to the rear, are being developed to eliminate blind spots. Relocation of mirrors has also been suggested to increase rear visibility. Ford has suggested that carmakers be permitted to continue their present cyclical model change pattern (about every three or four years) and phase in the new visibility-required designs on that basis.

HS-012 547

## 5N. Occupant Protection

## CUMULATIVE REGULATORY EFFECTS ON THE COST OF AUTOMOTIVE TRANSPORTATION

Ad Hoc Com. on the Cumulative Regulatory Effects on the Cost of Automotive Transp., A05040

For primary bibliographic entry see Fld. 4C.

HS-012 540

## 5O. Propulsion Systems

## THE SOLAR ERA

V94 N11

H. R. A. SchaeperE. A. Farber

See serial citation

\*Electric automobiles, \*Solar powered vehicles, \*Battery chargers, \*Corvairs, \*Nickel cadmium batteries, \*Dual battery systems, \*Battery life, \*Voltage regulation, \*Solenoids, \*Temperature, \*Battery design, \*Air pollution control, \*Road tests, \*Stirling engines,

A 1962 Corvair Monza 900 was converted into a test-bed for battery electric propulsion to determine technical problems associated with the development of electric vehicles for urban traffic. The battery system operation and design, the charger voltage regulation process, and control circuit function are outlined. Research and development of solar engines are being conducted. Road tests results were: a maximum attained speed of 58 mph and an initial motor starting current of approximately 1200 amp, which dropped rapidly as the vehicle built up speed. The principal operational difficulty was the gradual rising temperature of the propulsion battery combined with its reduced capacity under very high discharge currents.

HS-012 552

## 5R. Steering Control Systems

## VEHICLE HANDLING AND DYNAMICS

Daimler-Benz (West Germany), D01800

R. UhlenhautK. Enke

In HS-012 507

\*Vehicle handling, \*Vehicle dynamics, \*Vehicle control, \*Vehicle performance, \*Driver vehicle road interfaces, \*Performance characteristics, \*Vehicle road interface, \*Performance tests,

Criteria for establishing vehicle handling standards are discussed. Vehicle handling tests methods are described and evaluated.

HS-012 526

## DESIGNING SUSPENSION SYSTEMS FOR RADIAL PLY TIRES

For primary bibliographic entry see Fld. 5V.

HS-012 551

## ZUR STABILITÄT DER KURVENFAHRT EINES KRAFTFAHRZEUGES MIT UND OHNE TANGENTIALBESCHLEUNIGUNG (ON THE STABILITY OF TURNS OF A MOTOR VEHICLE WITH AND WITHOUT TANGENTIAL ACCELERATION)

V1 N1

P. Lugner

Text in German.

See serial citation

\*Turning, \*Vehicle stability, \*Angular velocity, \*Acceleration, \*Braking, \*Friction, \*Deceleration, \*Speed, \*Tire pavement interface, \*Steady state, \*Oversteer, \*Understeer, \*Vehicle center of gravity,

As can be shown in the treatment of the steady-state turn, the conditions for stability in a turning motion limit the speed of travel partly due to friction limitations. At transient turns (braking or accelerating in a turn) the stability changes considerably enlarge absolute values of the tangential acceleration and may lead to a considerable further decrease of the maximum speed of travel.

HS-012 566

## SKID PREDICTION

For primary bibliographic entry see Fld. 5A.  
HS-012 567

## DYNAMICS OF PNEUMATIC TIRE VEHICLES WITH CONNECTED SUSPENSION SYSTEMS

V1 N2  
E. Saibel M. C. C. Tsao  
See serial citation

\*Vehicle dynamics, \*Pneumatic tires, \*Suspension systems, \*Skidding, \*Skid control, \*Mathematical models, \*Load transfer, \*Shock absorbers, \*Cornering, \*Turning radius, \*Tire forces, \*Tire skid resistance, \*Tire pavement interface, \*Equations of motion, \*Tire spring rates, \*Coefficient of friction, \*Damping, \*Degrees of freedom, \*Vehicle kinematics,

A vehicle model, with 10 degrees of freedom is used to investigate the skidding conditions of any wheel of the vehicle in motion. Equations for the load transfer and equations for the pneumatic tire spring and shock absorber are derived. Parameters such as gradual cornering, U-curve cornering, the wavy road surface of different wave lengths, and cases of independent and connected suspension systems are inputs to the system. The tire calculated forces and their corresponding maximum resistance forces are the outputs of the systems. A connected suspension system is found to resist skidding better than the independent suspension system. The system is non-linear, and numerical solutions are obtained.

HS-012 568

## TRACTOR-SEMITRAILER DYNAMICS: DESIGN OF THE FIFTH WHEEL

For primary bibliographic entry see Fld. 5T.  
HS-012 569

## 5T. Trucks And Trailers

### DOT'S FOUR-POINT PROGRAM TO REDUCE TRUCK NOISE

Department of Transp., D17400  
For primary bibliographic entry see Fld. 2G.  
HS-012 549

### PILOT STUDY OF HOUSETRAILER AND TRUCK CAMPER SAFETY, PHASE 2. FINAL REPORT

California Univ., Inst. of Transp. and Traf. Engineering, C17000  
C. K. Wojcik R. L. Mellinger RTA-13945-13640; PB-  
Sponsored by California Div. of Highways. Prepared in cooperation with the Federal Hwy. Administration.  
NTIS

\*Campers (truck mounted), \*Accident analysis, \*Vehicle handling, \*Single vehicle accidents, \*Wind tunnel tests, \*Production statistics, \*Towing, \*Driver characteristics, \*Aerodynamics, \*Weight to power ratio, \*Vehicle mileage, \*California, \*Multiple vehicle accidents, \*Vehicle vehicle collisions, \*Data acquisition, \*Data reduction, \*Data analysis, \*Vehicle stability, \*Time of accidents, \*Day of week, \*Month, \*Accident report forms, \*Questionnaires, \*Vehicle control, \*Surveys, \*Accident types, \*Highway characteristics, \*Accident responsibility, \*Ontario, \*Vehicle performance, \*Vehicle age, \*Accident factors, \*Accident causes, \*Injury rates, \*Fatality rates, \*Mobile homes, \*Vehicle characteristics, \*Tire characteristics, \*New Mexico,

The study involved accident data collection and analysis, a mail survey of California house trailer owners, and wind tunnel testing of truck camper models. Data on the towing vehicle, the trailer coach, house trailer usage, safety and vehicle handling, and driver characteristics and experience are tabulated. Analyses of accident reports from the California Highway Patrol, the New Mexico State Highway Department, and the Department of Transport, Ontario, Canada showed a high percentage of single vehicle accidents among house trailers and truck campers, which indicates that these vehicle may have handling and control problems. The vehicles in the California sample show low rates of accident involvement in terms of mileage exposure. Wind tunnel tests results indicate that relatively large aerodynamic forces are involved in truck camper operations.

HS-012 560

## TRACTOR-SEMITRAILER DYNAMICS: DESIGN OF THE FIFTH WHEEL

V1 N2  
W. E. Tobler A. I. Krauter  
Supported by the Eaton Corp.  
See serial citation

\*Vehicle dynamics, \*Tractor semitrailers, \*Fifth wheel design, \*Equations of motion, \*Truck stability, \*Jackknifing, \*Turning, \*Braking, \*Truck handling, \*Yaw, \*Pitch, \*Roll, \*Mathematical models, \*Load shifting, \*Tire side forces, \*Axle loads, \*Turning radius,

The nonlinear equations of motion are derived for a tractor semitrailer where both the tractor and the semitrailer yaw, pitch, roll, and translate. Special emphasis is placed on the constraints imposed by the fifth wheel on the vehicle motion. In particular, the effects of two proposed fifth wheel design changes on the jackknifing behavior of a vehicle in a turning, braking maneuver are studied. The results demonstrate that the tendency of the vehicle to jackknife can be reduced with a geometric modification of the fifth wheel.

HS-012 569

## LAWS REGULATING OFF-HIGHWAY VEHICLES

VL N8 (Dec  
National Com. on Uniform Traf. Laws and Ordinances, N14400  
J. W. English  
GPO \$1.25

\*Off the road vehicles, \*Recreational vehicles, \*Uniform Vehicle Code, \*State laws, \*Canada, \*Traffic laws, \*Accident reporting laws,

Snowmobiles, all-terrain vehicles, golf carts, trail bikes, minibikes, dune buggies, and similar off-highway vehicles are motor

HS-800 787

## 5V. Wheel Systems

### INTERACTION OF HIGHWAY DESIGN AND VEHICLE PERFORMANCE--TIRES

Firestone Tire and Rubber Co., F12600  
C. E. Stair  
In HS-012 507

## Field 5—VEHICLE SAFETY

HSL 73, No. 09

### Group 5V—Wheel Systems

\*Tire safety, \*Tire failures, \*Tire wear, \*Tire standards, \*Tire failure caused accidents, \*Tire traction, \*Tire design, \*Driver emergency responses, \*Tire inflation pressure, \*Tire maintenance, \*Tire research, \*Wet road conditions.,

Research and development directed toward tire safety improvements can have positive results in reducing accidents only if the role of tires in accidents is more accurately known. Four statistical studies of accidents are briefly reviewed and it is concluded that current emphasis of federal tire safety standards on tire design and manufacturing covers only a minor portion of the tire safety problem. Tire wear, underinflating, traction on wet pavement, and lack of skill of drivers in emergency situations are prominent factors in tire related accidents. Current and possible future tire safety efforts of the tire industry discussed, include improved materials and designs for better wet pavement traction and resistance to injury; tire run-flat capacity; and low inflation warning devices.

HS-012 527

### THE CASE FOR STUDDED TIRES

V9 N3

See serial citation

\*Studded tire bans, \*Studded tires, \*Icy road conditions, \*Tire skid resistance, \*Tire studs, \*Braking, \*Steering, \*Tire traction, \*Pavement wear, \*Front tires, \*Rear tires, \*Tire tread patterns, \*Stopping time, \*Stopping distance, \*Tire performance,

Statistics gathered over the past five years by various snowbelt states and the provinces of Canada show that four studded tires provide a 30 to 50% improvement in stopping ability on glare ice, a 50 to 60% improvement in steering control, and a 200% improvement in traction. Studs are banned in Hawaii, Louisiana, Mississippi, Minnesota, and Utah, and usage is restricted to arbitrarily determined periods in 26 other states due to fear that studs accelerate pavement and highway marker wear, and that studs come loose and become projectiles. The latest type of stud design has been shown to reduce stud-caused road wear by about 50%. Slightly more costly pavements could be formulated that would be practically immune to stud-caused wear. Studs should be used on all four tires. Because of the problem of tread design and the accuracy required for drilling, studs should be purchased from and installed by a tire specialist.

HS-012 546

### DESIGNING SUSPENSION SYSTEMS FOR RADIAL PLY TIRES

V81 N2

J. P. Covington

See serial citation

\*Radial tires, \*Automobile handling, \*Suspension systems, \*Tire properties, \*Tire riding characteristics, \*Steering, \*Tire noise, \*Vehicle control, \*Tire vibration,

Properties of radial tires are described and the advantages and drawbacks of radial tires are mentioned. Advantages include better handling qualities, high-speed smoothness, durability, impact resistance, and better gasoline mileage. Drawbacks include cost, increased tire noise, and low speed harshness. U. S. automobile manufacturers are moving increasingly into radial ply tires as standard equipment. To fully realize the advantages offered by these tires, vehicle suspension systems must be carefully tuned to their unique engineering characteristics. Work

being done by Ford Motor Co. and General Motors Corp. to improve vehicle-radial tire compatibility and thereby reduce the undesirable effects of radial tires, is discussed.

HS-012 551

### DYNAMICS OF PNEUMATIC TIRE VEHICLES WITH CONNECTED SUSPENSION SYSTEMS

For primary bibliographic entry see Fld. 5R.

HS-012 568

### MECHANICS OF PNEUMATIC TIRES

Michigan Univ., M36600

ED., S. K. Clark NBS-Mono-122

Includes HS-012 574—HS-012 583.

GPO \$4.75

\*Pneumatic tires, \*Tire mechanics, \*Tire performance, \*Tire materials, \*Tire cords, \*Bonding, \*Laminates, \*Stress analysis, \*Deformation analysis, \*Tire pavement interface, \*Tire skid resistance, \*Vehicle control, \*Structural analysis, \*Tire design, \*Rubber, \*Friction, \*Mathematical models, \*Tire properties,

The current state of tire mechanics is assessed both theoretically and experimentally. Chapters cover tire material characteristics, including rubber structure, properties, and friction; tire cord structure, cord-to rubber bonding, and properties of tire cords and cord-rubber laminates; tire structure, stress, and deformations; contact between tire and roadway; skid resistance and directional control; and the tire's relationship to the vehicle as a whole.

HS-012 573

### RUBBER STRUCTURE AND PROPERTIES

S. D. Gehman

In HS-012 573

\*Tire materials, \*Rubber compounds, \*Structural analysis, \*Physical properties, \*Tire tests, \*Elasticity, \*Viscoelasticity, \*Carbon black, \*Thermodynamic properties, \*Dynamic tests, \*Abrasion tests, \*Stress strain characteristics, \*Molecular structure, \*Cracking, \*Energy absorption, \*Hardening, \*Tear strength, \*Creep, \*Curing, \*Equations, \*Tire wear resistance, \*Pneumatic tires,

Results of tests of physical properties of tire compounds, including stress-strain, aging, tear, hardness, dynamics, flex cracking, and rubber abrasions are presented mathematically. Tire composition, and rubber elasticity and viscoelasticity are analyzed, and the advantages of reinforcement of rubber with carbon black are outlined.

HS-012 574

### FRICTION OF RUBBER

Michigan Univ., M36000

K. C. Ludema

In HS-012 573

\*Tire materials, \*Rubber, \*Friction studies, \*Tire pavement interface, \*Tire slip motion, \*Tire performance, \*Tire road contact forces, \*Mathematical analysis, \*Wet road conditions, \*Dry road conditions, \*Coefficient of friction, \*Brake torque,

May 14, 1973

## VEHICLE SAFETY—Field 5 Wheel Systems—Group 5V

The classical laws of friction, terminology of the mechanical classes of friction, and a new delineation of the basic mechanisms or components of rubber friction are discussed. Dry and wet friction, the effect of rubber properties on friction, and longitudinal and lateral tire slip and slid are mathematically analyzed.

HS-012 575

### TIRE CORD STRUCTURE AND PROPERTIES

Massachusetts Inst. of Tech., M15000

S. Backer

In HS-012 573

\*Tire cords, \*Mathematical models, \*Tire mechanics, \*Stress analysis, \*Tensile strength, \*Compression tests, \*Tire cord tests, \*Tension tests, \*Elasticity, \*Filament wound tires, \*Bending, \*Geometry, \*Stress strain characteristics, \*Fibers, \*Tire materials, \*Torsion, \*Friction studies,

The structure of tire cords is illustrated by geometric models of singles and plied yarns. The mechanics of tensile behavior of tire cords and the bending mechanics of twisted structures are mathematically analyzed.

HS-012 576

### RECENT DEVELOPMENTS WITH TIRE CORDS AND CORD-TO-RUBBER BONDING

Toray Industries, Inc. (Japan), T25500

T. Takeyama J. Matsui

In HS-012 573

\*Tire cords, \*Bonding, \*Adhesives, \*Tire cord tests, \*Rayon tires, \*Nylon tires, \*Polyester tires, \*Filament wound tires, \*Fiberglass, \*Steel wire, \*Impact tests, \*Fatigue tests, \*Curing, \*Durability tests, \*Twisting, \*Tensile strength, \*Heat treatment, \*Physical properties, \*Stress strain characteristics, \*Shrinkage, \*Vulcanizing, \*Breaking energy, \*Tension tests, \*Rubber compounds, \*Adhesion,

The physical properties of various types of tire cords, including high tenacity rayons and nylons, polyester, fiber glass, steel wire, and miscellaneous cords are outlined, and a comparative analysis of various tire cords is presented. The results of impact and fatigue resistance tests of tire cords are represented graphically, and the effects of twist on cord properties are evaluated. Methods of rubber-to-cord bonding; adhesive treatment of nylon, rayon, and miscellaneous tire cords; polyester to rubber bonding; and an evaluation of adhesion are presented.

HS-012 577

### PROPERTIES OF CORD-RUBBER LAMINATES

Michigan Univ., M36600

S. K. Clark

In HS-012 573

\*Tire cords, \*Rubber, \*Laminates, \*Elasticity, \*Tensile strength, \*Tire cord tests, \*Tire ply number, \*Pneumatic tires, \*Mathematical representations, \*Fatigue tests, \*Fatigue (materials), \*Stress strain characteristics, \*Rayon tires, \*Nylon tires, \*Shear modulus, \*Tire characteristics, \*Breaking,

The elastic properties and strength and fatigue failure mechanisms of cord reinforced rubber for rayon, nylon, and

miscellaneous tire cords are evaluated, and the results are represented mathematically.

HS-012 578

### STRUCTURE OF THE TIRE

V. E. Gough

In HS-012 573

\*Pneumatic tires, \*Structural analysis, \*Structural design, \*Tire cords, \*Tire manufacture, \*Tire loads, \*Tire mechanics, \*Load transfer, \*Tire casings, \*Tire ply number, \*Tire materials, \*Tire inflation pressure, \*Mathematical analysis, \*Tire deflection, \*Tire beads, \*Crossply tires, \*Radial tires,

Pneumatic tire structure and flexible filament and soft matrix constructions are discussed. Tire construction methods and factors determining the selection of cord path are examined. Methods of cord length calculation are presented; manufacturing methods are analyzed; and the mechanism of tire load carrying is discussed. Approximate mathematical analyses of pneumatic tire structure are included.

HS-012 579

### TIRE STRESS AND DEFORMATION

Firestone Tire and Rubber Co., F12600

J. D. Walter

In HS-012 573

\*Tire load limits, \*Tire inflation pressure, \*Stress analysis, \*Deformation analysis, \*Mathematical analysis, \*Tire performance, \*Stress measurement, \*Transducers, \*Strain gauges, \*Tension (mechanics), \*Tire mechanics, \*Tire cords, \*Mathematical models, \*Shear stress, \*Bias tires, \*Polyester tires, \*Tire beads,

The methods of stress and deformation analysis are applied to three structural components of the automobile tire: the rubber matrix, cords, and steel beads. Methods of determining solutions for inflation and centrifugal loads and measuring inflation cord and inflation bead tension and cord rubber interface shear stress are presented. At the present time in order to study the tire in operation, stress analysis must be confined to investigation of mathematical models of the whole or part of the tire. Experimental techniques of stress analysis are summarized with emphasis on the use of transducers for strain measurement.

HS-012 580

### THE CONTACT BETWEEN TIRE AND ROADWAY

Michigan Univ., M36600

S. K. Clark

In HS-012 573

\*Tire pavement interface, \*Tire slip motion, \*Tire road contact forces, \*Mathematical models, \*Stress analysis, \*Tire deflection, \*Pavement skidding characteristics, \*Shear stress, \*Wet road conditions, \*Water effects, \*Aircraft tires, \*Tire tread patterns, \*Hydroplaning, \*Braking forces, \*Tire soil interface, \*Tire inflation pressure, \*Cornering, \*Tire prints, \*Tire tread depths, \*Pneumatic tires,

Experimental data and mathematical models are examined for three characteristics of a rolling elastic tire: the area of contact, slip motion, and normal and tangential stresses between the tire

Group 5V—Wheel Systems

and road. The roadway surface and possible contaminants between tire and roadway are studied with emphasis on the marked effect of water on contact processes at high velocities.  
HS-012 581

SKID RESISTANCE AND DIRECTIONAL CONTROL

Natural Rubber Producers' Res. Assoc., Inc. (England), N30800  
A. Schallamach  
In HS-012 573

\*Tire skid resistance, \*Vehicle control, \*Friction, \*Tire road contact forces, \*Pavement skidding characteristics, \*Tire side forces, \*Cornering, \*Braking forces, \*Tire slip motion, \*Tire traction, \*Hydroplaning, \*Wet road conditions, \*Snow tires, \*Studded tires, \*Icy road conditions, \*Tire tread patterns, \*Tire casings, \*Velocity, \*Rubber compounds, \*Wet skidding, \*Mathematical analysis, \*Pneumatic tires, \*Coefficient of friction, \*Brake torque, \*Turning radius, \*Aircraft tires, \*Skid resistance tests, \*Crossply tires, \*Radial tires,

Speed and direction of a vehicle are controlled by the forces between tires and road. These forces have an upper limit set by the available coefficient of friction; once the ratio between horizontal traction and normal pressure exceeds this limit anywhere in the contact area, local sliding occurs. Sliding friction has no preferred direction; effective control is therefore lost when sliding extends over the whole contact area. The advantage of the pneumatic tire is that it can travel at an angle to its plane and/or with a velocity differing from its circumferential velocity without involving the whole contact area in sliding motion. Cornering and side force, braking and circumferential slip, and speed dependence of rubber friction are mathematically analyzed. Skid resistance of winter tires, and tread pattern and carcass construction effects on tire friction

are discussed. Hydrodynamic and tread compound effects and the velocity dependence of the braking coefficient on wet roads are studied.

HS-012 582

THE TIRE AS A VEHICLE COMPONENT

Technische Hogeschool, Delft (Netherlands), T08100  
H. C. A. Van Eldik Thieme H. B. Pacejka  
In HS-012 573

\*Tire mechanics, \*Tire performance, \*Tire tests, \*Tire moments, \*Tire test equipment, \*Tire forces, \*Tire dynamics, \*Tire rolling resistance, \*Braking forces, \*Tire characteristics, \*Tire traction, \*Tire temperature, \*Cornering, \*Yaw, \*Tire loads, \*Tire deflection, \*Camber, \*Tire manufacture, \*Mathematical models, \*Tire uniformity, \*Tire inflation pressure, \*Tire slip motion, \*Tire pavement interface, \*Tire road conditions, \*Tire skid resistance, \*Coefficient of friction, \*Skid resistance tests, \*Radial tires, \*Bias tires, \*Bias belted tires, \*Crossply tires, \*Road tests, \*Tire vibration, \*Tire side forces, \*Steady state, \*Equations of motion,

The results of straight line rolling experiments are examined to determine load-deflection relationships, effective rolling radius, and tire rolling resistance. Braking behavior and tire traction is studied. Tire nonuniformities produce variations in forces applied by the tire to the vehicle and result in periodic vehicle vibrations. Cornering and camber experiments are reviewed to determine variations in lateral tire deformation and deflection and tire slip angle. The influence of braking and traction on cornering and difficulties in measuring forces and moments are discussed. Low and high frequency properties of tire in-plane dynamics are examined, and yaw and camber analysis is performed.

HS-012 583





U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
Office of Administration  
WASHINGTON, D.C. 20590  
OFFICIAL BUSINESS  
Penalty For Private Use, \$300

POSTAGE AND FEES PAID  
NATIONAL HIGHWAY TRAFFIC SAFETY  
ADMINISTRATION  
517



CARNEGIE LIBRARY  
AUG 24 1973  
OF PITTSBURGH